Technical Change, Labor Absorbtion and Living Standards in Rural Andalucía, 1886–1936

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Economic historians have specified the land problem in Spain as one of the reasons for the failure of the Second Republic and for the nation's bitter Civil War between 1936 and 1939.[1] They have especially singled out the region of Andalucía in the southern part of the country for the underutilization of its agricultural resources, concentration of landed property, and the poverty experienced by much of its rural population. If the economic rationality of pre-Civil War farming methods in Andalucía is now better understood, historians continue to emphasize the social costs, identifying the miserable conditions in which many agricultural laborers lived as the inevitable result of an extensive farming system with low wages and a highly seasonal employment demand. These conditions led an appreciable number of people to take an interest in radical politics, especially anarchism. But, whereas a number of historians have studied social protest, tracing both the development of coherent ideologies and organization of action against landlord or the state during the half century prior to the Civil War, little or no work has been done to show whether the plight of farm laborers improved or deteriorated during the same period. This article tries to remedy this gap in the literature by examining changes in the long run supply and demand for labor in agriculture. It then considers the implications of these changes on worker's living standards. The main conclusion is that, although rural poverty was acute, it is difficult to find evidence of it worsening over the 50 years prior to the 1936–1939 Civil War.

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1. See for example Edward Malefakis, *Agrarian Reform and Peasant Revolution in Spain: Origins of the Civil War* (New Haven and London: Yale University Press, 1970).

Land in Andalucía was usually held in large estates, *latifundios,* which provided most of the work opportunities for the local population. The various land reforms of the late-eighteenth and nineteenth centuries had failed to change significantly a property distribution inherited from earlier centuries. As a result, 46 percent of the land belonged to only 0.5 percent of land owners in 1930.[2] Concentration of agricultural property in the hands of a minority was far from unique to Andalucía, however. The experience of England, for example, during the eighteenth and nineteenth centuries suggests that large farming units are not in themselves incompatible with relatively high land and labor productivities. This had led some economic historians to advance other arguments to explain the relation between agricultural performance and economic backwardness in Andalucía. Bernal and Tedde have suggested that Spain's protectionist cereal policy after 1891 acted as a disincentive to farmers to change production methods, as they could obtain sufficient profits in an assured market.[3] Other researchers have made it clear that the region did witness some changes in the 50 years prior to the Civil War, both in the type of crops cultivated and technology used.[4] If change was slow therefore, it seems that this was because the large supplies of underutilized labor often acted as a disincentive to capital investment, and that traditional farming methods were both profitable and economically rational given local factor and commodity prices.[5] To assess the long-term supply and demand for agricultural labor, this study considers the provinces of Cádiz, Córdoba, Jaén and Sevilla, representative of the region, both with respect to the type of agriculture (a predominance of dry cereal farming and olive plantations),

2. Pascual Carrión, *Los latifundios en España* (Madrid: 1932), Tables 1 and 2. Figures refer to those provinces studied in this article, namely Cádiz, Córdoba, Jaén and Sevilla.

3. Antonio Miguel Bernal, "El rebaño hambriento en la tierra feraz," in Domínguez Ortiz, ed., *Historia de Andalucía* vol. VIII (Madrid: Cupsa Editorial, Madrid and Planeta, Barcelona, 1981), 65; and Pedro Tedde de Lorca, "Sobre los orígenes históricos del subdessarrollo andaluz," in Sánchez-Albornoz, *La modernización económica de España 1830–1930* (Madrid: Alianza Editorial, 1985), 309.

4. See, for example, Ignacio Jimenez Blanco, *La producción agraria de Andalucía Oriental, 1874–1914* (Madrid: Universidad Complutense de Madrid, 1986): Francisco Zambrana Pineda, *Crisis y modernización del olivar español, 1870–1930* (Madrid: Instituto de Estudios Agrarios, Pesqueros y Alimentos, 1987); and Santiago Zapata Blanco, *La producción agraria de Extremadura y Andalucía occidental, 1875–1935* (Madrid: Universidad Complutense de Madrid, 1986). One recent estimate suggests that in 1931, land productivity in Andalucía was 93 percent of the national average, and labor productivity 73 percent. James Simpson, "Los límites de crecimiento agrario en España, 1860–1936" in L. Prados de la Escosura and V.Zamagni, eds. *El desarrollo económico en la Europa del sur* (Madrid: Alianza, 1992).

5. Antonio Miguel Bernal, *Economía e historia de los latifundios* (Madrid: Instituto de España, Espasa Calpe, 1988); Tedde de Lorca, *sobre los orígnes,* 306–9; and James Simpson, "La elección de técnica en el cultivo y el atraso de la agricultura española a finales del siglo XIX," *Revista de Historia Económica* V (1987): 271–99.

and because they contained some of the main centers of political and social unrest.

In the first instance, an examination of the supply of agricultural labor for the region is required. Census figures provide a rough estimate of the size of the agricultural labor force, although like most employment statistics from less developed countries, they contain a number of important shortcomings. First, differences exist between the various censuses in classifying economic activities. Second, two features of the agricultural labor market in Andalucía, the short-term labor contracts and the significant seasonal fluctuations in demand, led to difficulties in the definition of an individual's employment. Because there was a general lack of alternative rural employment or temporary out-migration during this period, it seems unlikely that employment statistics in agriculture would have been biased upwards. Indeed the highly seasonal nature of demand implies that the agricultural labor force itself was supplemented for short periods by labor not only from other sectors of the economy, but also from other regions. Third, the use of female labor, a vital component in the short-term supply of agricultural labor, is virtually absent in the employment statistics, representing only 4 percent of the total in 1887 and 0.4 percent in 1930. This finding understates significantly the participation of this group of workers, who performed important tasks such as weeding, binding, and stooking during the cereal harvest, and collecting fallen fruit during the olive. However, as all shortcomings appear to have remained relatively constant over the period, the figures in Table 1 can be regarded as an approximate indicator of the labor force dependent on the agricultural sector in the region. The table shows that the total population of the four provinces grew at a faster rate than the agricultural population for all periods. Between 1887 and 1920 the numbers employed in agriculture increased at an annual rate of only 0.2 percent, compared to a total population growth of 0.8 percent. However, in the decade prior to the Second Republic employment in agriculture increased much faster, reaching an annual 0.7 percent. At the same time the sector's share of total active population during the last decade fell from 59.3 percent to 55.5 percent.[6]

Another difficulty relevant to this analysis is that the figures in Table 1 do not indicate the quantity of work carried out by those employed in the sector. Chayanov argued that a peasant family's economic behavior was likely to be very different from that of a capitalist farmer's, as the former's labor input would be determined by the "irksomeness of the extra work," and not the point where the marginal product equalled the wages that the

6. Whereas total numbers in agriculture in Andalucia grew by 11 percent between 1887 and 1930, in the rest of Spain they fell by 13 percent.

TABLE 1. Population and Active Labor Force in Cádiz, Córdoba, Jaén and Sevilla

	1887	*1900*	*1920*	*1930*
total population	1,833,257	1,946,870	2,409,133	2,656,730
total active pop.	728,165	721,536	821,400	945,213
total employed in agriculture	456,018	475,948	487,204	524,358
% of labor force in agriculture	62.6	66.0	59.3	55.5
% annual growth	*total population*		*employed in agriculture*	
1887–1900	0.5		0.3	
1900–1920	1.0		0.1	
1920–1930	1.0		0.7	
1887–1920	0.8		0.2	
1900–1930	1.0		0.3	
1887–1930	0.9		0.3	

Sources: Calculated from Dirección General del Instituto Geográfico y Estadistico, *Censo de la Población de España,* 1887 (Madrid: 1891), vol.2, pp.572–73 and *Censo de la Población de España en 1900* (Madrid: 1907), vol.3, Ministerio de Trabajo, *Censo de la Población de 1920* (Madrid: 1929) vol.5 and *Censo de la Población de España. Región de Andalucía 1930* (Madrid: 1943).

capitalist farmer had to pay.[7] In other words, a family might consider it worthwhile to carry out a particular agricultural operation which, on a larger farm, would have been regarded as unprofitable. Likewise, small farmers could cultivate crops profitably that were labor intensive in their requirements and maximized total revenue per hectare, but which would have been regarded as unprofitable on larger farms using wage labor.[8] If this theory is correct, and a considerable body of development literature suggests it is, then those with access to land would theoretically have worked more days a year than those employed as *jornaleros* or day workers on the *latifundios.* In addition, the high level of property concentration in Andalucía implied that the possibility of the agricultural sector absorbing population growth satisfactorily was less than it might have been if smaller farms had been the norm. Although it is clear that many farms did

7. Booth and Sundrum, *Labour Absorption in Agriculture* (Oxford: University Press, 1985), 132.

8. These points are found in the writings of contemporaries. See for example Pascual Carrión on the need for small holdings for irrigation, "La concentración de la propiedad y el regadío en Andalucía," *IV Congreso Nacional de Riegos* (Barcelona: 1927): 3–17; and Bernaldo de Quiros to diversify crop mix to increase employed labor otherwise redundant, Ministerio de Trabajo y Previsión. Dirección General de Acción Social, *La crisis agraria andaluz de 1930–1* (Madrid: 1931).

vary their size during the period, the overall balance between large estates and small family farms appears to have varied little, and for our purposes we assume that the movement in labor demand caused by changes in the structure of property ownership is irrelevant.[9]

The demand for labor, as contemporaries were aware, also depended on the crop mix. The main products of the region were wheat, barley, and olive oil that between them covered 80 percent of the cultivated area and accounted for 70 percent of the total value of arable output in 1922.[10] The region also had two specialized wine areas: sherry in Jerez de la Frontera and adjacent lands, and a lesser "fino" around Montilla (Córdoba). However, viticulture accounted for only 3 percent of agricultural produce, and 2 percent of the area sown.[11] Cattle, in general, were kept for farm work and transportation, rather than milk or meat. Finally, the planting of "new" crops, such as cotton, rice, and sugar beets was relatively unimportant (see Table 2).

As both the type of crops grown and methods of cultivation changed little during the period, a reasonably acceptable estimate of labor demand can be obtained based on contemporary sources of labor requirements for individual crops and changes in the area sown. This section examines some of the problems involved in such a calculation, namely the various field rotations, different geographical areas, and short-term fluctuations in demand. Afterwards, the question of technological change and labor demand for the main crops (cereals, legumes and olives) is discussed. Appendix 2 contains full details of the sources used.

The long summer droughts encouraged an extensive agriculture based on dry farming techniques. At the beginning of the period the predominant cereal rotation was one of three fields (*al tercio*), which consisted of a single sown field, usually wheat, an unploughed fallow (*rastrojo* or *erial*), and finally a ploughed fallow (*barbecho*). Within this general system there were large variations, depending essentially on the quality of the soil and distance from product and labor markets. Part of the *barbecho* might be sown with chick-peas or beans and the *rastrojo* with oats or barley.[12] Another variant dedicated all the manure and fertilizers to a small area,

9. Rather than changes in the structure of property ownership, there was a movement by landowners away from leasing to farming directly. However, as leasing had been usually in large units, no apparent changes in labor demand were evident.

10. Other cereals and legumes accounted for a further 11.7 percent of the value. Ministerio de Fomento, *Avance estadístico de la producción agrícola en España* (Madrid, 1922).

11. Value is for must only. Blending and maturing increased significantly the final value of the product.

12. Dirección General de Agricultura, Industria y Comercio, *Avance estadístico del cultivo cereal y leguminosas asociados en España* (hereafter *Avance cereal*) (Madrid: 1891), Cádiz,1,p.287, Córdoba, 1, pp.423–4, Sevilla, 3, pp.110–11.

TABLE 2. Area of Crop Cultivation, 1886/90–1930/35 (in hectares)

	Dry farming				*Irrigation*		
	1886/90	*1905/10*	*1922*	*1930/5*	*1905/10*	*1922*	*1930/5*
Cereals							
wheat	471614	514083	463204	461901	2108	4880	4380
barley	176644	186795	237680	251220	2081	1360	1390
rye	44165	17858	6082	5014	71	0	0
oats	10533	58542	59150	60660	0	0	0
maize	26273	15307	21219	47363	5950	6314	7005
rice	0	0	0	0	5	0	377
others	18799	19216	23457	22689	70	221	0
sub-total	748028	811801	810792	848847	10285	12775	13152
Legumes							
chick-peas	53802	47641	63965	73974	0	0	16
beans	42670	59985	51146	55822	1792	1635	485
lentils	16890	7546	9122	5051	0	0	0
field peas	5088	13734	12586	3711	0	0	0
others	9973	3502	10838	12284	609	1234	1039
sub-total	128423	132408	147657	150842	2401	2865	1542
Olives	566028	675586	721915	828666	12199	21780	25666
Vines	55444	31257	35890	34436	0	0	0
Raw materials							
cotton		0	312	10802		0	366
tobacco		0	125	237		0	74
esparto		10140	11760	1031		0	0
sugar beet		0	0	2268		0	5269
others		3526	2982	2113		128	45
sub-total	n.a.	13666	15179	16451		128	5754
Roots, tubers & bulbs							
potatoes		1884	503	1914	3500	6326	5916
onions		784	140	476	1455	2201	1338
others		890	620	581	1655	2216	775
sub-total	n.a.	3558	1263	2971	6610	10745	8029
Market gardening							
sub-total	n.a.	4754	3915	5667	11927	9810	14218
TOTAL	1497923	1673030	1736611	1887882	43422	58107	68561

Sources: See Appendix 1

perhaps 5 percent of the land found in the *al tercio* rotation and usually nearest the farm or town, and planted it annually. Also widespread was a two-field rotation (*año y vez*) that alternated wheat and barley on the sown area with the other half left fallow. In general, there was a decline during the period in the area of fallow relative to the area sown, and in this

respect the *año y vez* began to be regarded as a more intensive field rotation than *al tercio.*[13]

Apart from the *Avance estadístico del cultivo cereal y leguminosas asociados en España* for 1886–90, there is no information available on the amount of land to be found in the main crop rotations. This is not a significant problem, however, in calculating labor requirements for each crop because the effects of different rotations on labor demand can be separated into two distinct categories. The first contains operations that can be measured independently of rotations, either by volume of inputs (such as fertilizers and manure), or directly associated with the size of the harvest. The second category is concerned with the nature and timing of different ploughings. In the case of Córdoba in Table 3, which for our purpose can be regarded as representative of the region, the *total labor demand per hectare sown* changed little with respect to the various rotations, although the quantity of land required to obtain a hectare of production of wheat, barley, or chick-peas naturally varied. Long rotations served as an economic way of resting the land, and their later abolition would be caused by the spread of improved farm machinery and artificial fertilizers.

A second consideration is that labor inputs were greater on the richer soils of the *Campiña* (the plain) than those in the *Sierra* (uplands). An accurate adjustment for geographic location is difficult, as very few sources mention either the distribution of crops by area, which would allow a study of the changes over time, or the differences in labor requirements. Instead, an average figure for labor requirements has been calculated for tasks based on all rotations and areas. Another problem concerns short-term fluctuations in labor demand caused, for example, by unusual climatic conditions or changes in factor and commodity markets. When these factors directly influenced the area cultivated, or the size of harvests, they can be included in the calculations. However, nonessential tasks such as hoeing or weeding, which frequently provided a large number of days work, were especially prone to significant annual variations. Given the difficulties in identifying these fluctuations, this study ignores these short term changes.[14]

The period considered coincides with the first serious attempt to mechanize some agricultural activities, and this development had repercussions on labor demand. Given the nature of crop mix and nature of mechanization that took place in the four provinces, discussion centers only on cere-

13. Grupo de Estudios de Historia Rural, "Evolución de la superficie cultivada de cereales y leguminosas en España 1886–1935", *Agricultura y Sociedad* 29 (1983): 285–325.

14. For example, *El Progreso Agrícola y Pecuario,* no.1684, 30/4/31 reports that the Governor of Sevilla banned the use of harvesters in those areas of the province where unemployment existed.

TABLE 3. Labor Requirements for Cereal-Legume Rotation in Córdoba (days per hectare)

	1886/90		*1934a*	*1934b*	
Type of rotation	*1/3*	*1/1*	*1/3*	*1/3*	*1/1*
Fallow					
1st ploughing	3.0	—	3.1	5.0	—
2nd ploughing	3.0	—	2.4	3.1	—
3rd ploughing	2.0	—			
sub-total	8.0	—	5.5	8.1	—
Wheat					
planting	5.0	9.5	5.2	5.2	11.2
Barley					
planting	5.0	9.5	5.2	5.2	11.2
Chick-peas					
planting	5.0	8.0		11.0	11.0
TOTAL	23.0	27.0	15.9	29.5	33.4
average per					
hectare sown	8	9	8	10	11

Sources: JCA. *Avance cereal,* op.cit. Córdoba vol.1, 423–31 and Instituto de Reforma Agraria, *Datos recopilados sobre las provincias de Ciudad Real, Toledo, Córdoba, Jaén y Sevilla* (Madrid: 1934), 177–83.

Note: 1934a refers to upland farming, and 1934b to farming in the plain.

als and olives. One major problem is that the first census of agricultural implements occurred only in 1932, and contemporary observations have to be used to complete the picture for earlier periods.[15]

At the outset of the period, traditional ploughs (the *arado común* or *romano*) were the most widespread in all parts of the region, although some farmers were changing to modern ploughs.[16] The advantages to farmers of low cost, low energy requirements, easy construction, and maintenance of traditional ploughs were offset by their shallow plowing depth and inability to lay a regular furrow, both characteristics that made this plough unsuitable for the deeper autumn and winter ploughings.[17]

Agronomists suggested that crop output could be increased by switching from the *arado común* to a *vertedera,* a plough that had been fitted with a mouldboard, although traditional ploughs would remain satisfactory for the spring ploughing, which needed to be shallow to minimize moisture loss. Attempts in Sevilla to introduce multi-furrow ploughs date

15. Ministerio de Agricultura, Dirección General de Agricultura, *Anuario estadístico de las producciones agrícolas. Año 1932,* (Madrid: 1933) (hereafter *Anuario, 1932*), 318–26.

16. Puente y Rocha, *Memoria sobre el estado de la agricultura en la provincia de Córdoba* (Córdoba:1875), p.12 and *Avance cereal,* Córdoba, 406, Jaén, 181 and Sevilla, 130.

17. Simpson, *la elección de técnica,* 279–281.

from the 1880s, if not earlier, although they remained unimportant in comparison to the *arado común* or the *vetedera* (see Table 4).[18] By the Second Republic the region's stock of ploughs had changed much more quickly than in the rest of Spain with only 35 percent of the total remaining the traditional *común* type in contrast to 63 percent nationally.[19]

The implications for the labor demand of these changes is complicated, as not just the type of ploughs have to be considered, but also the work animals employed, and the number of ploughings carried out. The number of ploughings itself was a function of both their quality (winter ploughings tended to require more labor) and the marginal product of an extra ploughing (depending on wage labor costs, availability of animals, commodity prices, etc.). As shown in Table 5, the *vertederas* had greater labor requirements because they worked the soil more deeply, and therefore more slowly. However, there were productivity gains to be obtained by switching from using oxen to mules in plough teams. Complete information is only available for Sevilla and Córdoba, but it suggests that mule teams increased from 34.7 percent of the total in 1891 to 64.4 percent in 1933.[20] Although statistically it cannot be shown that the diffusion of the *vertedera* with its greater labor requirements was offset exactly by the increased numbers of mules (and consequently greater labor productivity), the evidence contained in Table 5 suggests that there was probably no significant change in labor demand, at least for ploughings.

It can be safely assumed that in the nineteenth century with very few exceptions all crops were harvested by hand. The traditional method of cutting grains was with a curved hook, olives were beaten to the ground with long sticks, grapes cut from the vine with knives, and legumes collected by hand. These methods would continue until the Civil War with the notable exception of small grains.[21] As estimated in Appendix 2, the 4,952 reapers of differing types to be found in the four provinces by the Second

18. Noriega noted that a few farmers were using multi-furrow ploughs for all ploughing tasks, thus obtaining savings on human and animal labor, but at the expense of poor quality winter ploughings. Noriega y Abascal, *La tierra labrantía y el trabajo agrícola en la provincia de Sevilla* (Madrid: 1897), 117 and *Avance cereal,* Sevilla, 130–1.

19. The distribution of traditional ploughs was very uneven, representing 67 percent of the total in Cádiz, 27 percent in Córdoba, 13 percent in Jaén and 45 percent in Sevilla. Calculated from *Avance. . . . año 1932.*

20. Only cattle and mules have been considered, as horses were rarely used as yoke animals. Dirección General de Agricultura, Industria y Comercio, *La Ganadería en España. Avance sobre la riqueza pecuaria en 1891* (Madrid: 1892), vol. 4, 7, 34. Ministerio de Agricultura, Dirección General de Agricultura, "La ganadería en España", in *Tres estudios económicos. Apéndice al Anuario estadístico de las producciones agrícolas. Año 1933,* (Madrid: 1934), 75–84.

21. The first harvester was tested in the late 1850s, but they were still rare at the end of the century. Françios Heran, *Tierra y parentesco en el campo Sevillano: la revolución agrícola del siglo XIX* (Madrid: Ministerio de Agricultura, 1980), 190, Simpson, *la eleción técnica,* 285.

TABLE 4. Farm Machinery in Use in Cádiz, Córdoba, Jaén and Sevilla, 1932

Ploughs	
común	61,728
mouldboard	110,934
multi-furrow	2,347
Reapers	2,095
Reaper-binders	2,810
Combine-harvesters	47
Threshers	
threshing board	14,434
board with disks	17,862
winnowing machine	799
threshing machines	480
Tractors	888

Source: Ministerio de Agricultura, *Anuario estadístico de las producciones agrícolas. Año 1932* (Madrid: 1933), 318–23.

TABLE 5. Labor Requirements for Ploughing and Sowing, Sevilla (days labor per hectare)

	1886/90	*1897*[a]	*1897*[b]	*1897*[c]	*1934*[d]	*1934*[e]
1st ploughing (*alzar*)	3.00	2.17	3.22	3.16	3.00	5.00
2nd " (*bina*)	2.50	1.85	2.85	2.70	2.50	4.00
3rd " (*tercia*)	2.50	1.66	2.23	2.40		
Seedbed preparation	5.00	3.32	3.32	4.83	3.00	4.00
Sub-total	13.00	9.00	11.62	13.09	8.50	13.00
Sowing	0.50	n.a.	n.a.	n.a.	2.50	5.00
Total	13.50				11.00	18.00

Source: JCA *Avance cereal,* Sevilla 3, 124 and 130; Noriega, *la tierra labrantía,* 109–15 and 120–32, and IRA, *datos recopilados,* 315–25.

Notes: [a]traditional plough and mules used; [b]mouldboard and mules; [c]traditional plough and oxen; [d]Sierra; [e]*Campiña,* using a mouldboard.

Republic would cut about one-third of all small grains. Change, at least with cereals, appears to have been significant by the end of the period.

When organizing harvest labor using traditional methods, the farmer had to choose between speed, which inevitably resulted in some damage to the crop and spillage, or the maximization of harvest output at the expense of hiring more labor. As the harvest was a time-bound operation, lower yields and poor quality resulting when collection was too early or late, the collection method frequently depended on the quantity of work available (harvest size) and the available labor force. In general, the farmer wanted to harvest in the shortest possible time to protect the crop from

disease, pests and theft, while the farm worker normally aimed to maximize his *total* harvest earnings by working more days, even if this involved a lower hourly rate. As a result, worker militancy was frequently aimed to coincide with the harvest.

The productivity of harvest labor therefore varied according to the form of labor contract established (piece work or day wage), the method of collection, and the acquiesce of the labor force. It also varied according to harvest size. Data in Appendix 2 suggests that larger cereal harvests in the period 1930/1935 in comparison with those at the beginning of the period implied an increase of approximately 2.5 days/ha in collecting time for costs. Consequently, the 807,254 hectares cropped with cereals in 1930/1935 (rice and maiz are excluded) would have required an extra 2.02 million days to collect if harvesting methods had remained unchanged. However, the greater use of reapers and reaper-binders, which required only 3.5 days/ha and 0.5 days/ha respectively, implied a saving of 2.24 million days work on the 265,655 hectares where they are calculated to have operated. By their nature these figures are very approximate, but changes in technology seemed to offset the greater labor requirements to collect the larger harvests at the end of the period in comparison with the beginning.

The olive showed no changes in technology or cultivation methods during the period. A recent study of traditional methods in the olive harvest has noted that when a harvest doubles from one year to the next (not infrequent with this crop), a harvester is able to collect approximately 50 percent more in an hour.[22] Using the results of this time study, we attempt to calculate the time required to harvest a hectare in each province, based on annual yields.[23]

The form of transport used in carting these crops depended on the economic situation of the farmer, state of roads, and nature of terrain.[24] The cost of transport also varied according to the distance travelled and the seasonal demand for animals. Estimates of transport costs are available for various years, but sufficient information does not exist to give satisfactory figures for different crops over time.[25] Instead, a fixed figure of 1.25 days/sown hectare has been used for the whole period,

22. See Appendix 2.

23. For details and figures for the provinces of Córdoba, Jaén and Sevilla, see Simpson, *Agricultural Growth and Technical Change: The Olive and Vine in Spain, 1860–1936* (Unpublished Ph.D. thesis, University of London), 236–40 and 409–17.

24. Animals were used throughout the period, although motor transport was sometimes used to carry olives toward the end, Dirección General de Agricultura y Montes, *El aceite de oliva en España,* hereafter *el aceite de oliva* (Madrid: 1923), 345. The cost of a pack horse might be two and a half or three times as much when the terrain was steep and dangerous than when it was flat. Noriega, *la tierra labrantía,* 139.

25. For example, *el aceite de oliva,* 280, 324, 336 and 345; Noriega, *la tierra labrantía* pp.139–47 and Ministerio de Fomento, *Información Vinícola* (Madrid: 1886), 40–3.

which assumes implicitly that transport productivity increased in line with yields.[26]

Four methods of threshing grains can be distinguished: treading under hoof, threshing boards, threshing machines and, very rarely, combine harvesters. The use of loose animals occurred rarely and mainly on the large horse breeding estates, where animals costs were low and labor not plentiful.[27] The most widespread method involved the use of boards pulled by animals on threshing circles where the grain was separated by either flints or iron rollers set into the boards. Threshing machines, although more costly and requiring a greater feed area than mechanical reapers, appear to have been more widely established in Andalucía at the start of the period, although this was not the case by the Second Republic. As has been argued elsewhere, the reason for their early appearance with respect to reapers appears to be that they were less likely to require repairs, the operation was less time-bound than harvesting, and the savings were achieved on a relatively scarce resource at the end of the century, animal power, whereas reapers increased the demand.[28]

By 1932 some 20 percent of grains were threshed mechanically (see Appendix 2). Given that crop yields increased by approximately the same amount, a single figure based on the area cropped can be used for all years.[29] The century prior to the Civil War witnessed significant changes in the processing of olives in Andalucía. Manjarres y Bofarrull noted in the 1870s that cylindrical shaped stones in the olive mills were being substituted first by conical *rulas* and later by *rulos,* both leading to improved labor productivity.[30] However, it was the changes that occurred at the end of the century, coinciding with the growth in exports of olive oil for culinary purposes, that transformed the industry. The old wooden presses, especially the *vigas,* were replaced with ones worked by hydraulic sys-

26. This is the average time given to carry wheat and barley in Córdoba in 1886/90; *Avance cereal,* Córdoba, 418–19.

27. Ibid., Sevilla, 145.

28. Simpson, *la eleción técnica,* 292–95. Figures taken from Noriega, *la tierra labrantía,* 105–6, 149–53 shown the following productivity, in hectolitres:

method	*daily output*	*no men*	*output per man*	*output per animal*
animals-hoof	60.0	25	2.400	2.50
threshing boards	7.5	4	1.875	3.75
threshing machine "Ramsomes"	135.0	22	6.136	135.00

29. This assumes, of course, that diffusion of threshing machines occurred at a similar rate as improved yields were obtained.

30. Manjarres y Bofarrull, *El aceite de oliva* (Madrid: 1896).

tems; factories for the chemical extraction of oil from the *orujos* became more common; and a totally new operation, refining, took place on some oils, although the site of the refineries was more likely to be found near ports, rather than areas of production.[31]

Examination of tax returns in Table 6 shows the speed of change in the region's presses.[32] The hydraulic presses were preferred for their greater power and ease of operation, although they also had important cost advantages and implications for labor demand. To calculate the effect of these changes on labor absorption, we used another excellent study by Noriega, written in 1899. Estimated labor time to process a ton of olives was 2.38 days when using a single *rula* and *viga* press, and 1.52 days when two *rulos* and a hydraulic press were used.[33] The hydraulic press used in Noriega's calculations had a capacity of 75 fanegas/24 hours, which would appear to have been small by 1921, when the average productivity in Córdoba was calculated at 143 fanegas/day. However, the difference in labor requirements per unit of production was small: 656 kilos of olives per laborer in the case of Noriega's hydraulic press and 625 kilos in Córdoba. Total labor demand can therefore be calculated based on 2.21 days per tonne in 1886/90, and 1.6 days in 1921, as given for Córdoba.[34]

From the brief discussion above it can be seen that changes did occur in the agriculture of the region, but their effects on labor demand were often offset partly, or totally, by other factors. From this information, and changes in the area cultivated, it is possible to measure long-term movements in work opportunities during the period.

31. Other changes to be noted include the production of virgin oil, *aceite fino,* which involved a duplication of storage equipment to keep the oil from the various pressings seperate, and the use of laminated iron or tin for storage containers, instead of traditional materials which were difficult to clean and contaminated the oil. These changes occurred especially after the First World War. Simpson, *thesis,* 173–186 and Zambrana, *Crisis y modernización.*

32. Because of the nature of this source, the actual numbers of press are inevitably underestimated. In this respect, see Pequeño y Muñoz, *Nociones acerca de la elaboración del aceite de oliva* (Madrid: 1879), 333.

33. Noriega also mentions a more advanced system in his study, worked by steam and requiring a capital outlay 7 or 8 times greater than the normal hydraulic press, with a capacity to handle 280 fanegas of olives daily, E. Noriega y Abascal, "Memoria acerca de la fabricación de aceites en la provincia de Sevilla" (1901), reprinted in *Agricultura y Sociedad* 19 (1981). This appears to have been large even by 1921 standards, when the provincial agronomist in Córdoba separated hydraulic presses into two categories according to whether they processed 120 or 180 fanegas daily (in 20 hours). *El aceite de oliva,* 348.

34. This assumes 80 percent of the olives were processed with equipment which had the productivity of Noriega's *rula* and *viga,* and 20 percent by *rulos* and hydraulic press, a ratio based on the figures given for 1889/90 in Table 6. Figures for other years are obtained by extrapolating those of 1889/90 and 1921, producing a figure of 1.32 days in 1935, reflecting the continual increase in the quality of presses. However, as the processing of olives only accounted for 5 percent of labor demand in 1931–5, total labor demand for this crop would increase by 46 percent over the century.

TABLE 6. Olive Oil Presses According to Type, 1856–1930

	a	*b*	*c*	*d*	*e*
1856	—	—	202*	127	3477
1889/90	69	23	—	202	665
1905	209	99	58	222	514
1910	283	84	64	219	490
1922/3	615	128	166	197	324
1930	1458	132	283	249	209

Source: J.Monlau, *Tratado de olivicultura* (Mallorca: 1877), 285 and Dirección General de Contribuciones, Impuestos y Rentas, *Estadística administativa de la Contribución Industrial y de Comercio* (years as above).

Notes: (*a*) hydraulic, water, steam, gas driven; (*b*) hydraulic, animal powered; (*c*) hydraulic, human powered; (*d*) traditional presses, *husillo;* (*e*) traditional presses, *rincón, torre y viga.*

*includes presses of "double presion". All have been assumed to be human powered.

The figure in Table 7 suggests that labor opportunities moved from a low of approximately 108 days/year to a high of 130 in 1921–25 for male workers.[35] These figures are on the low side, although by how much is difficult to establish as contemporaries and historians are far from agreement on a figure. For example, Noriega estimated 280 days work for male workers, and 120 for female or children in the province of Sevilla in 1897, compared to a figure of only 155 days by Fuentes Cumplido in 1903.[36] However, a number of other factors have to be considered. First, the calculation in Table 7 excludes weeding cereals and legumes, a task that traditionally employed large numbers of people, especially women, but that varied considerably in its intensity from year to year.[37] If this task is included in the total at the rate of 7 days/ha/year, then our estimate of the total labor demand can be increased by approximately 15 days annually. Second, the accuracy of the nineteenth-century crop areas and livestock figures have been questioned, and they may be underestimated by 10 or 15 per cent.[38] These two corrections would suggest an average figure for the period not very short of that of Fuentes Cumplido. Finally, also ex-

35. Given the low census figures for female workers (see above), the labor opportunities for all agricultural workers will be similar to those noted here. Annual figures for crop areas for cereals, legumes, olive and vines have been used, and those from Table 2 for other crops.

36. Noriega, *la tierra labrantía,* 84 and Fuentes Cumplido, *Memoria que obtuvo el accesit en el Concurso del Instituto de Reformas Sociales de 1903* (Madrid: 1904). Among historians, Bernal has suggested 180 days (*El rebaño hambriento,* 86).

37. In periods of drought, or other periods deemed unsuitable by landlords, this task could be omitted. See Díaz del Moral, *Historia de las agitaciones campesinas andaluzas* (Madrid: Alianza Editorial, 1977 ed.), 206–7.

38. See James Simpson, "La producción agraria y el consumo español en el siglo XIX", *Revista de Historia Económica* 7/2 (1989): 359–61.

cluded are all tasks related to management, agricultural fixed investment, forestry, fishing and hunting, and scavenging (legal and illegal).

Whereas Table 7 perhaps does not clarify the great differences in labor opportunities as noted by contemporaries, it does shed some light on the long-term trends. The changes in technology and areas cropped do not appear to have diminished labor opportunities over the 50 years prior to the Civil War, but rather supply increased roughly in line with demand.

Agricultural workers' living standards depended not just on work opportunities but the level of wages and the cost of living. To establish a general framework for discussion, the prices of wheat, bread, olive oil, and agricultural wages are shown in Graph 1 (for details of sources and methods used, see Appendix 3).

Between the mid-nineteenth century and the start of the twentieth long-term change in nominal wage levels appears minimal. This fact is suggested by the figure of 1.75 pesetas a day for hoeing in Sevilla in contemporary studies of 1864, 1888 and 1904.[39] Likewise, the survey 1849–1856 gives a daily wage of between 1 and 1.5 pesetas for all Andalucía, which is only slightly less than the 1.25 and 1.5 provided in the survey of the *Comisión de Reformas Sociales* in 1905.[40] Some time shortly prior to the First World War, wage levels started moving upwards slowly, but more spectacular increases occurred in the periods 1918–1921 and 1927–1933. Between these two periods wages fell back slightly, but not to previous levels. Bread was the principal foodstuff for the landless laborer, a commodity that because of low agricultural productivity and tariffs was relatively expensive in Spain. However, although the situation is confused in the period prior to 1913, after this date it is clear that wages increased more than wheat prices. Furthermore, in an article in defense of wheat farming and tariff policy, Manuel de Torres in 1934 drew attention to the fact that for every year since official statistics had begun (1913) wheat prices were below that of the general price index. Graph 1 shows that after 1913 wheat prices moved higher than did those for bread.[41] The prices of olive oil (another important part of local diets) showed a much stronger

39. Hidalgo Tablada, *Curso de Economía Rural Española* (Madrid: 1864), vol.1, 297; *La Crisis agrícola y pecuaria,* (Madrid: 1887), vol.3, 634 and C. Benítez Porral, *Memoria que obtuvo el accesit en el Concurso "El problema agrario en el Mediodía de España* (Madrid: 1904), 139.

40. AMA Bancos Agrícolas, Leg. 123, exp. 4–4 bis, quoted in Moral Ruiz, *La agricultura española a mediados del s.XIX, 1850–1870* (Madrid: Ministerio de Agricultura, 1979), 119, and Instituto de Reformas Sociales, *Resumen de la información acerca de los obreros agricolas en las provincias de Andalucía y Extremadura* (Madrid: 1905). In this survey, out of 51,525 replies, 14 percent claimed an average wage of 1.75 pesetas a day, 48 per cent 1.5 pesetas 26 percent 1.0 pesetas.

41. Manuel de Torres, "El precio del trigo y del pan" in *Agricultura Revista Agropecuaria* 6/64 (1934): 231–33.

TABLE 7. Estimate of Labor Demand in Agriculture

	labor demand (in millions of days per year)							*Labor supply**	*Days work year*
	Cereals	*Legumes*	*Olives*	*Vines*	*Others*[+]	*Fert.*	*TOTAL*		
1886–90	16.96	2.54	17.82	4.44	2.44	0.67	44.875	415,795	108
1898–00	21.32	3.48	18.08	3.39	2.44	0.73	49.433	420,775	117
1901–05	19.59	3.05	20.60	2.34	2.44	1.01	49.038	418,054	117
1906–10	19.09	2.76	20.12	2.50	2.44	1.15	48.061	413,440	116
1911–15	18.81	2.69	22.07	2.76	2.48	1.31	50.116	408,827	123
1916–20	18.96	2.93	23.83	2.82	2.52	1.15	52.196	405,728	129
1921–25	19.12	3.45	24.64	2.86	2.82	1.48	54.367	416,630	130
1926–30	19.52	3.63	25.91	2.64	3.17	1.51	56.370	434,090	130
1931–35	19.64	3.10	26.01	2.76	3.76	1.54	56.806	451,550	126

Sources: See text and Appendix 2.

Notes:

*Labor supply calculated by interpolation of figures for males employed in agriculture in the censuses, removing our estimates for herdsmen (see Appendix 2.6).

[+]Because of lack of statistical material, labor demand during the first three periods has been assumed similar to that of 1906–10.

Days work per year has been calculated by dividing total labor demand for crops by the total male agricultural population, net of herdsmen (i.e., "labor supply").

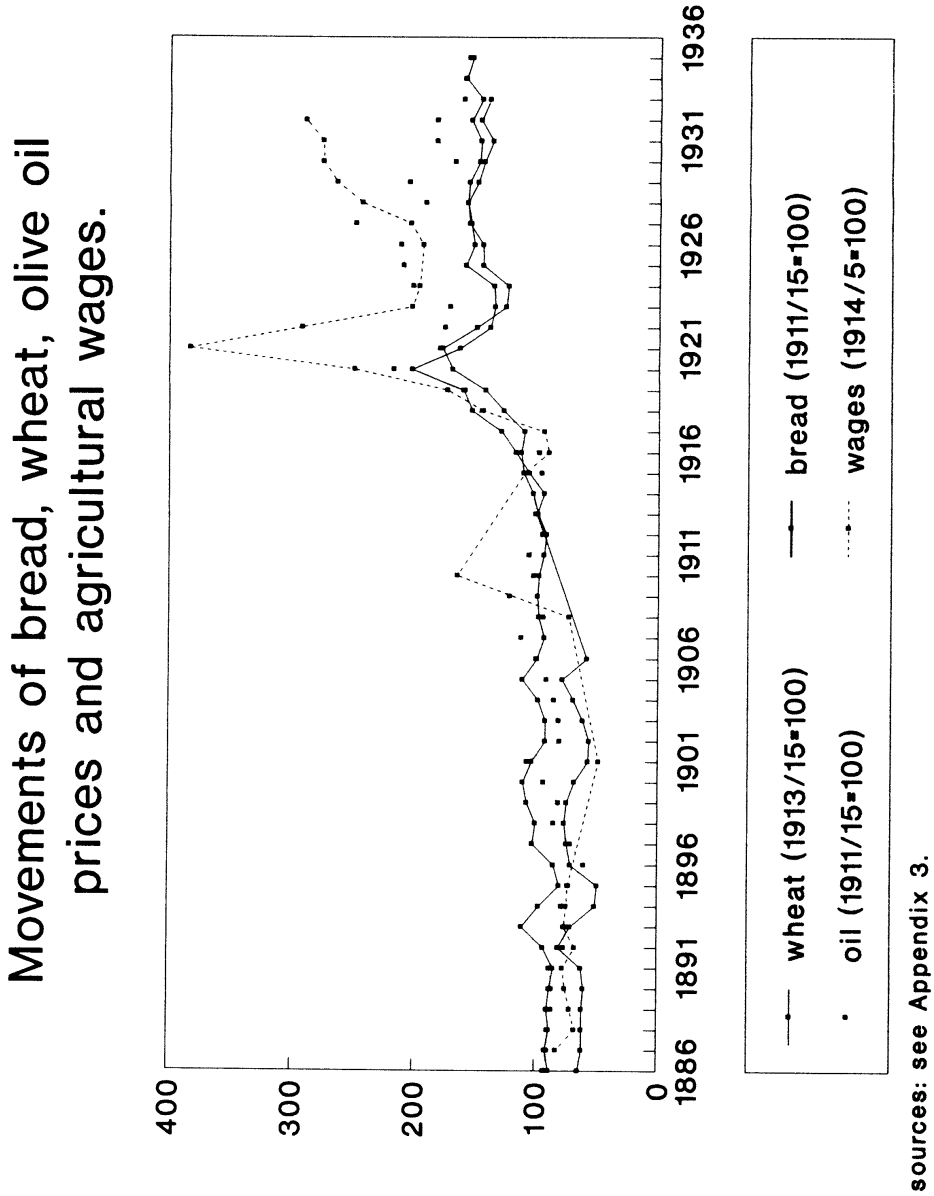
tendency to rise than those of wheat toward the end of the period, but again are below those of wages from the First World War.

Living conditions in Andalucía for the vast majority remained extremely harsh, even if, according to the evidence concerning wages, bread prices, and work opportunities as presented here, there does not appear to have been any long-term deterioration. At first sight, therefore, there appears to have been no clear economic reason for the greater labor militancy in the countryside in Andalucía after the First World War. However, other factors were also present.

First, if there was no long-term deterioration in living standards in Andalucía, other groups in society most definitely did see an improvement, as average per capita incomes grew between 56 and 62 percent during the period 1890 and 1930.[42] Information on wage rates and living standards for other categories of workers in Spain at this time is still sketchy, although Maluquer de Motes has suggested that real industrial wages showed a slight tendency to increase prior to the First World War, followed by a 50 percent growth between 1913 and 1933, better than most estimates for the rural laborers in Andalucía.[43]

42. Calculated from Prados de la Escosura (1988), 59 and 228.

43. In *Estadística históricas de España siglos XIX–XX* (Barcelona: Fundación Banco Exterior, 1989), 506–7.



Second, government intervention did little to improve the plight of farm workers, which was often desperate and had been for at least two centuries.[44] The limited work opportunities available, as described above, together with an efficient rural police, which restricted illegal access to the land, were compounded by the absence of a "Poor Law" or of subsidized food.[45] Indeed, the large commercial farmers benefited from Europe's highest cereal prices because of tariff protection and an especially benevolent tax system.

Third, and perhaps crucial, short-term fluctuations in harvests, especially for olives, caused considerable hardship that the activities of neither central or local governments mitigated.

Finally, Andalucía had a long history of social discontent, and rural anarchism its deepest roots in Europe. Although this unrest had existed well before our period, its importance had previously been less because of the lack of worker organization. Likewise, laborers' aims shifted over time from a desire to obtain direct access to land to improved working conditions (better salaries, less piece work, shorter days, etc.). The success of these worker organizations depended in part on the attitude of governments, and the rural uprising of 1918–1919 and 1931–1933 can be seen as attempts by landless laborers to take advantage of relatively favorable political situations. The latter period also coincided with a period of rising unemployment and falling commodity prices, which led Malefakis to note that "Spain had probably been the only nation in the world in which wages had actually risen during the Depression."[46]

The failure of the democratically elected governments of the Second Republic (1931–1936) to implement a wide-reaching land reform, which would have led to a major redistribution of income, alienated many workers.[47] By contrast, the constant discussions on the need to change property rights, and the immediate threat of rising labor costs, worried landowners. Thus government's failure to make significant concessions to the landless in Andalucía, together with threats to property, especially after the land invasions of February 1936, divided society. Even if land workers

44. Writing in the mid-eighteenth century, Olavide described the Andalucía agricultural workers as ". . . the most unfortunate men I know in Europe." Cited in Richard Herr, *The Eighteenth Century Revolution in Spain* (Princeton: Princeton University Press, 1958), 105.

45. Exceptions to the above were short term public works programs carried out by the government, or the authorities encouraging land owners to take on labor and/or provide soup kitchens in periods of acute hardship.

46. Malefakis, *agrarian reform,* 329.

47. The cause of this failure is the subject of the important work by Malefakis. The disastrous olive harvest of 1930/1, which was only 15 percent of the average of those of 1925/29, together with the growing importance of the international depression, implied that the period immediately prior to the Second Republic was associated with unusually high unemployment and political tensions in Andalucía.

in Andalucía did not see a long-term decline in their living standards between 1886 and 1936, as this paper has shown, their failure to participate in the economic growth of the country and to escape from extreme poverty posed serious problems for Spain's democratically elected governments of 1931–1936. The consequent divisions in society were a major cause of the Civil War that broke out in July 1936.

APPENDIX I: Notes for Table 2, DISTRIBUTION OF CROPS, 1886/1890–1930/1935

1. 1886/90. Areas sown have been calculated by dividing the total production in each *partido judicial* by the yield of the most appropriate crop rotation: *al tercio* in the cases of Cádiz, Córdoba and Sevilla, and a weighted balance of *al tercio, año y vez* and *anual* for Jaén. In addition: *Cádiz*—the following yields have been used: rye 10 hl., oats 13 hl., maize 8.5 hl. and bird seed 7.5. As no crop figures are given for the districts of Cádiz and San Fernando, the totals of the other districts have been increased by 10 percent. *Córdoba*—an estimate of 15,000 has of rye, 1,500 of maize, 4,000 oats, 700 bird seed and 2,000 lentils has been used, based on later surveys for this province. *Jaén*—the information for the *partido judicial* of Jaén looks particularly suspect, and consequently the area of barley has been reduced by 20,000 hectares, and that of wheat increased by the same amount.

2. 1905/10. The figures for roots, tubers and bulbs, and fruit trees refer to 1905/09, and those of raw materials and market gardening to 1906/10. The figure for irrigation in market gardening has been obtained using the ratio found in 1922, and for olives from JCA, *El Regadío en España* (Madrid: 1904). The irrigated and nonirrigated area of potatoes has been obtained using the ratio in JCA *Noticias estadísticas sobre la producción agrícola española 1902* (Madrid: n.d.), and those for onions and "others" in this category obtained using the same ratio.

3. 1922. All oranges assumed irrigated.

4. 1930/5. The figures for olives and vines includes areas still not in production. Information on roots, tubers and bulbs includes figures for potatoes and onions from market gardening. The figure for irrigation in market gardening has been obtained from the same ratio in 1922.

Sources: 1886–90: Dirección General de Agricultura, Industria y Comercio, *Avance estadístico(s)* (Madrid: 1891); 1905/10: Ministerio de Fomento, Dirección General de Agricultura, *Avance estadístico de la riqueza. . en España* (Madrid, 1913–15); 1922: Ministerio de Fomento, Dirección General de Agricultura y Montes, *Avance estadístico de la*

producción agrícola en España (Madrid, 1923); 1930/1: Ministerio de Agricultura, *Anuario estadístico*(*s*) (Madrid, 1931–6).

APPENDIX 2

1. *PLOUGHING AND SOWING. Cereals and Legumes.* The average labor requirement for ploughing and sowing for cereals in Sevilla was 13.5 days/hectare in 1886/90 and 14.5 in 1934 (see Table 5). Consequently the changes in plough types and draught animals can be regarded as small and excluded from the calculations. However, as a regional average, this figure is high because of the large areas of undercultivated hilly land, and a more conservative figure of 10 days/hectare has been used for all crops in this category (excluding rice and maize), being an average for Córdoba in 1886/90 and 1934, as shown in Table 3.

Olives. Annual cultivation tasks were susceptible to major short term changes in demand, as the farmer could not uproot his crop to plant another without incurring considerable expense. The government enquiry of 1888 suggests 21.5 days/ha., and that of 1934, 24 days in the *Campiña* of Sevilla, 17.5 in the *Sierra,* and approximately 25 in the *Campiña* of Córdoba (JCA *Avance estadístico sobre el cultivo y producción del olivo en España. 1888* (Madrid: 1891), pp.x–xv, and IRA *Datos recopilados,* 177–88 and 315–25. As short term trends are impossible to determine, 20 days/ha has been assumed the norm for all years.

2. *HARVEST LABOR. Cereals. Traditional methods.* The 1886/90 figures for collecting wheat, paying by time, are Córdoba 8.0 days, Jaén 6.0 and Sevilla 6.7, but appears not to include binding and stooking (*Avance cereal,* 1: 418; 2: 193–4, and 3, 144). Collecting by piece was quicker, and a general average of 7.5 days has been used per hectare. In 1934 figures that include binding and stooking are 13.0 and 9.3 days/ha. for Córdoba, and 13.0 and 8.0 for Sevilla in the *Campiña* and *Sierra* respectively. Consequently, an average of 10.0 days is used, to reflects the larger harvest (IRA, *datos recopilados,* pp.183, 317 and 323). For barley the average is increased by 1.0 days for both dates, and oats reduced by the same figure (Ibid., p.183).

Modern methods. No time studies for the provinces in the 1880s have been found, although a Wood's reaper in Zaragoza required 4.8 man days/hectare, against 2.5 in Huesca, the wheat being cut, bound and stook (*Avance cereal,* 2: 158 and 3: 478). In Córdoba in 1934, it required a labor force of 0.35 days, although if the reaper did not also bind. This had to be done by hand, needing 3.25 days in the Campiña and 2.30 days in the Sierra (*Datos recopilados,* 183). Changes in productivity of these machines during the period therefore appear limited. To calculate labor demand, it

has been assumed that labor requirements remained at 3.5 days/ha over the whole period using reapers, and 0.5 days/ha using reaper-binders. Annual use is calculated as 52.5 has., based on a daily 3 has., and working 17.5 days a year (*Revista Agricultura* (*junio* 1933): 366 suggests 15 days for reapers and 20 days for binders). Of the 807,254 hectares of small grains sown in 1930/5, an estimated 265,655 has., or about a third, was cut by machinery. Using the coefficients given above, this implies 415,673 days labor to collect the harvest from these 265,655 has., a saving of 2.24 million days if traditional methods had been used.

Legumes. Yields changed little over the period, so labor demand for harvest is regarded as fixed. The figure for chick-peas and field peas is 4.5 days/ha, and for beans 6 days. Other legumes are assumed to have required 5.0 days/ha.

Olives. Two factors are used to calculate the harvest labor requirements: the area cropped and an estimate of labor productivity based on tree yields (Source: Ministerio de Agricultura, *Explotaciones Olivares Colaboradoras, 2. Recolección, campaña 1973 y 1974, mecanización de la operación* (Madrid: Ministerio de Agricultura, 1976) and López Ontiveros, *El sector oleícola y el olivar: oligopolio y coste de recolección* (Madrid: Ministerio de Agricultura, 1978), 127–45. All olives have been assumed to have been collected by the *vareo* method, with windfall olives at 10 percent of harvest. Time includes moving groundsheets (*mallas*), collecting and sacking fruit. A minimum of 2.4 kilos/hour is assumed. The calculation is based on 90 trees/ha. in Cádiz, 100 in Córdoba, 93 in Jaén and 88 Sevilla (Ministerio de Agricultura, *Anuario estadístico de la producción agrícola, Año 1926* (Madrid: 1927), 108–9. The working day used is 7.5 hours (after Noriega, *la tierra labrantía,* 111). The yield per tree in 1886/90 taken as 11.25 kilos, the same as the average for Sevilla between 1900–25, and the production of olives as 560,368 tns (James Simpson, "La producción agraria en 1886–90: una enfoque de la agricultura española del siglo XIX", *Memoria Banco de España,* 1986, 28–29). For olive oil extraction, see text.

Maize. On non-irrigated land a figure of 17 days/ha is used for all operation, based on IRA *datos recopilados,* Sevilla pp.315–320. For irrigated land no figure has been found, and an estimated 30 days/ha is used.

3. *CARTING AND THRESHING.* A figure of 1.5 days/ha has been assumed for carting of all crops. As only about 20 percent of the cereal harvest appears to have been threshed mechanically, and crop yields had a tendency to increase by a similar amount, the quantity of labor to thresh the produce of a hectare is likely to have remained fairly constant over the period (productivity of threshers taken as 12.4 tonnes/day with annual use of 30 days, Noriega, *la tierra labrantía,* 150 and *Revista Agricultura,* [junio 1933]: 366). The following estimates are used for traditional methods, and include threshing, winnowing and cleaning of grain (based mainly on the

average between the *Sierra* and *Campiña* in Córdoba in 1934, IRA, *datos recopilados,* 183: wheat 4 days/ha, barley 5, oats 2.5, other cereals 4, chick-peas 3, beans 4 and other legumes 3).

4. *VINES.* The 1934 survey suggests about 42 days/ha in Córdoba (*Campiña*) and 92 (*Campiña*) and 90 (*Sierra*) in Sevilla IRA, *datos recopilados,* 321–26. For the earlier period, one estimate for Córdoba gives figures ranging from 150 days/ha in Montilla to 42 in the Sierra (Puente y Rocha, *Memoria,* 34). Labor demand in Spanish vineyards was highly elastic, depending on short term movements of factor and commodity prices and, although it is dangerous to assume no change in long term demand, it is impossible to arrive at a satisfactory figure. Given the generally higher labor requirements in viticulture than in most crops, a figure of 80 days/ha has been used.

5. *OTHER CROPS. Cotton.* Assuming the deep ploughing in June needed 12 days work when not done by tractor, the total labor requirements in Utrera (Sevilla) in the 1930s was 53.5 days/ha for non-irrigated land. Of this women were traditionally employed for approximately 30 days (especially during the harvest) which, if reduced by two thirds to produce male labor units, implies a total of 43.5. Sumpsi gives a figure for the same period of 55 days/ha, and an average of 50 has been used here. On irrigated land, the total figure for Utrera was 144 (or about 120 for male labor). Torrejón y Boneta, *Economía y Valoración,* pp.517–8 and J.M.Sumpsi "Estudio de la transformación del cultivo al tercio al año y vez en la campiña de Andalucía", in *Agricultura y Sociedad* 6 (1978): 60.

Sugar Beet. An average of 82.5 days is used, given by Sanz, et al., *el paro estacional,* 51, a figure slightly higher than the 75 days given for Córdoba, in IRA, *datos recopilados,* 177–88.

Potatoes. On irrigated land a figure of 76 days/ha is used (Sanz, et al., *el paro estacional,* p. 52). For nonirrigated land half this quantity is used.

Orange and Fruit Trees. A figure of 55 days/ha for all tasks has been used for irrigated trees (based on Sevilla, IRA, *datos recopilados,* 315–320). For non-irrigated trees an arbitrary 9 days, similar to that of olives in "deficient" cultivation (Sanz, et al., *el paro estacional*) is used.

6. *Livestock.* As no evidence of flock size is available, the following coefficients have been used, taken from Torrejón y Boneta, *Economía y Valoración,* 578–79:

horses, mules & cattle	1 man + 1 boy per 20 animals*
sheep	1 man + 1.5 boys per 300 animals
goats	1 man + 1 boy per 200 animals
pigs	1 man + 1.5 boys per 100 animals

**refers to stable work for yoke animals.*

In all cases boys have been taken as full time workers. The 1917 survey suggests that 75 percent of all horses and mules worked, and the above coefficient has been used. The rest were either too young or used for breeding, and the quantity of labor for these categories being estimated as only a half of the above. As beef cattle required much less labor than either milking cows or yoke animals, it is assumed that only 70 percent of the herd required the coefficients used above (based on the *vacuno al labor* for Sevilla and Córdoba found in the 1891 census), falling constantly to 48 percent in 1933 (which represents those animals found in the category of *leche* and *trabajo* of the survey of that year); the remainder have been calculated at half the above ratio. Finally, no figures are given by Torrejón y Boneta for asses, and this group has been treated identically as horses.

DAILY LABOR REQUIREMENTS FOR DIFFERENT ANIMALS

	1891	*1917*	*1933*
horses	6,471	10,408	7,810
mules	5,272	12,157	16,050
cattle	14,015	26,630	20,798
asses	2,626	4,769	5,614
sheep	6,417	10,937	9,581
goats	2,749	4,515	4,697
pigs	4,206	10,963	19,404
TOTAL	41,756	80,379	83,954

Sources: Dirección General de Agricultura, Industria y Comercio, *La Ganadería en España* (Madrid: 1891) 5 vols, Ministerio de Fomento, *Estudio sobre la ganadería en España* (Madrid, 1920) 2 vols; Ministerio de Agricultura, "La ganadería en España", in *Tres estudios económicos. Apéndice al Anuario estadístico de las producciones agrícolas. Año 1933* (Madrid. 1934).

7. *ARTIFICIAL AND NATURAL FERTILIZERS.* An increase in the use of artificial fertilizers is one of the characteristics of the period (see Domingo Gallego "Transformaciones técnicas de la agricultura española en el primer tercio del siglo XX" in Garrabou, Barciela and Jiménez Blanco eds, *Historia agraria de la España contemporánea,* vol.3, pp. 170–229 [Barcelona: Editorial Crítica, 1986].) A coefficient of 5 kilos of manure for every kilo of live weight has been obtained by dividing the quantity distributed according to the Ministerio de Fomento, *Material fertilizante empleado en la agricultura,* (Madrid, 1921), by the livestock figures of 1917 (the live weights used for animals are 3.26 QM for horses and mules, 3.71 vacuno, 1.72 donkeys, 0.77 pigs and 0.34 goats). This is less than half the figure calculated by Gallego for all Spain (10.91), which perhaps illustrates the low level of attention to this aspect of cultivation in these provinces. Sheep have been excluded from the calculation, as they spent significant amounts of time outside, and other types of manure such as urban rubbish, contents of cess pits and pidgeon coops, have also been ignored. Using the livestock census figures

of 1891, 1917 and 1933, an estimate of supply has been obtained which is extrapolated to other years. For artificial fertilizers, an average of 12,168 tonnes in 1907/8, 63,134 in 1919 and 83,543 tonnes in 1930/1 have been obtained, while prior to 1907 it has been assumed that the quantities involved were so small that they can be ignored. The only acceptable source to obtain an average figure for spreading fertilizers appears to be the *Avance cereal* of 1886/90, from which an average of 0.25 days/tonne is the time required to spread manure, and the cost of transport 4 pts/tonne can be converted to 0.75 days/tonne (*Avance cereal,* Córdoba 1, 408, Jaén 2, 182 and Sevilla 3, 132).

APPENDIX 3: Sources for Graph 1

BREAD PRICES. Averages for the provinces of Córdoba and Jaén as given in Conard,P. and Lovett,A. "Le prix du pain en Espagne, 1850–1930" In *Melanges de la Casa de Velazquez* (Madrid, 1969), vol.5, 436–39.

WHEAT PRICES. 1886–1906, average of the four prices as given in Sánchez-Albornoz,N. *Los precios agrícolas durante la segunda mitad del siglo XIX* (Madrid: Servicio de Estudios del Banco de España, 1975), 162 and Grupo de Estudios de Historia Rural, *Los precios del trigo y la cebada en España, 1891–1907* (Madrid: Servicio de Estudios del Banco de España, 1980), 185. For 1913–35, the figure is the national one given in París Eguilaz,H. *El movimiento de precios en España* (Madrid: CSIC 1943), 35.

OLIVE OIL. Sánchez-Albornoz,N. and Carnero,T. *Los precios agrícolas durante la segunda mitad del siglo XIX. Vol2. El vino y el aceite* (Madrid: Servicio de Estudios del Banco de España, 1982), 181 and Grupo de Estudios de Historia Rural, *Los precios del aceite y oliva en España, 1891–1916* (Madrid: Servicio de Estudios del Banco de España, 1981), 115. For 1890–1924, *andaluz corriente* quoted from the Memoria de la Camara de Comercio de Barcelona, in Instituto Geográfico y Estadístico, *Anuario estadístico de España,* 1920 (Madrid: 1922), vol.7, 190–92 and 1924/5 (Madrid: 1926), vol. 11, 286–87. For 1913–35, the figure is the national one given in París Eguilaz,H. *el movimiento de precios,* 41. When sources overlap, an average has been used.

WAGES. For years 1887–95 and 1891/2–1893/4, 1915/6 and 1921/2–1922/3 based on two estates in Sevilla, as given in González Arteaga "Los salarios en Puebla del Rio (Sevilla) durante la crisis finisecular (1887–1923)", in *Revista de Historia Contemporanea,* no.2 dic.1983, 125–45. For 1913–1931, wages for male workers in Cádiz, Córdoba and Jaén (maximum and minimum averaged), quoted in *Anuario estadístico de España,* different years.